A10 end

hardening said seal member after an inner volume of said panel becomes equal to a volume of said liquid crystal, wherein said first spacer is elastically deformable from an initial size thereof to a size corresponding to said appropriate cell gap, and said first spacer is deformed to the size corresponding to said appropriate cell gap.--

IN THE DRAWINGS:

Please amend FIGS. 1A, 1B, 1C, 2, 3A and 3C as shown in red in the attached copy of the drawings.

REMARKS

The specification has been amended to correct minor clerical errors and to employ more idiomatic English. Claim 2 has been rewritten in independent form. Claim 1 has been cancelled, and claims 3-5 amended to depend from claim 2. Pursuant to 37 CFR 1.121, marked copies of the amended paragraphs from the specification and amended claims accompany this amendment.

FIGS. 1A-1C and 2 have been amended as required by the Examiner. FIGS. 3A and 3C have been amended to correct a minor clerical error and to conform to FIG. 3B. Corrected formal drawings will be filed upon allowance of the application.

Turning to the art rejections, and considering first the rejection of claims 1, 2 and 4-6 as obvious over the admitted prior art (APA) in view of Shin et al., claim 2 has been written in independent form. It is submitted that claim 2, as amended, and the several claims directly or indirectly dependent thereon are not taught by or obvious from the art. None of the cited references are pertinent at all in view of total lack of technical thought of the present invention. The present invention is based on the fact that the liquid crystal falling-drop method has a unique problem as described in detail in the present specification. Although the falling-drop method itself is a well-known method, its unique problems are recognized by the Applicant (see

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specification page 6). Without recognizing the significant problems unique to the falling-drop method, it is not obvious to achieve the present invention.

In a conventional liquid crystal injection method, since the seal portion has an injection hole, it is possible to restore an appropriate cell gap at the liquid crystal injecting step. This is in complete contrast to the falling-drop method where the liquid crystal is sealed within the panel and thus, once a non-uniform cell gap is formed, it is difficult to restore an appropriate cell gap. According to the present invention, it is possible to prevent the central spacers from being excessively collapsed to a size smaller than the appropriate cell gap due to atmospheric pressure exerted the LCD panel (see specification page 13).

Shin et al. merely shows a liquid crystal injection method and is by no means related to the falling-drop method. Although the material of the cited spacers 40 is not disclosed, it is clear from the shapes of the cited spacers 40 shown in Fig. 6 that the spacers 40 have plasticity rather than elasticity. Accordingly, Shin et al. cannot be said to supply the missing teachings to the APA to achieve or render obvious the claimed invention.

Turning to the rejection of claim 3 as obvious from the APA and further in view of Teraguchi et al. and Hiraishi et al., it is submitted none of the applied art, the APA, Teraguchi et al. or Hiraishi et al. teaches or suggests a seal member having hardly deformable core as required by claim 3, or the advantages thereof. Teraguchi et al. and Hiraishi et al. are merely cited to show the sealing portion with a spacer. There is no hint as to the falling-drop method and its unique problems. In the rejection, the Examiner cites Hiraishi et al. as teaching spacers formed of a material which is hardly deformed when pinched between the substrates under atmospheric pressure. Even assuming arguendo the Examiner's interpretation of Hiraishi et al., Hiraishi et al.'s seal member does not include a deformable material surrounding the hardly deformable core as required by Applicant's claims. Thus, no combination of the APA and either or both of the

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secondary references applied to reject claim 3 can be said to achieve or render obvious claim 1, as amended, or the several claims directly or indirectly dependent thereon.

New claims 7 and 8, which have been added to further scope the claimed invention, are allowable for the same reasons above adduced relative to claim 1, as well as for their own additional limitations.

Having dealt with all the objections raised by the Examiner, the Application is believed to be in order for allowance. Early and favorable action are respectfully requested.

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our deposit account number 08-1391.

Respectfully submitted,

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Registration No. 24,315

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231 on November 20, 2002, at Tucson, Arizona.

By Diana Caro

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MARKED SPECIFICATION PARAGRAPHS

SERIAL NO. 09/855,148

DOCKET: NEC 142491

MARKED SPECIFICATION PARAGRAPHS SHOWING CHANGES MADE:

Paragraph beginning at page 3, line 9:

On the other hand, in the liquid crystal falling-drop method, the LCD panel is assembled through the steps mentioned below. The seal in the form of a closed line is formed around the display area on either one of the transparent substrates by a drawing printing using a dispenser or a screen printing, etc. And, the display area spacers are arranged on the transparent substrate by forming them or dispersing them. Thereafter, a suitable amount of liquid crystal is dropped onto the display area of the transparent substrate. Thereafter, one of the transparent substrates is stuck on the other and adhered to each other in a vacuum chamber. Then, the mutually adhered transparent substrates are left under atmospheric pressure, so that the transparent substrates are deformed by a pressure corresponding to a difference between atmospheric pressure and a negative pressure within the LCD panel to reduce the gap between the transparent substrates. The seal is hardened at a time when a desired cell gap is obtained by such deformation of the transparent substrates.

Paragraph bridging pages 4 and 5, beginning at page 4, line 27:

FIG. 1A to FIG. 1C show cross sections of a LCD panel 20 fabricated by the conventional method. The LCD panel 20 is the TFT driven, color LCD. As shown in FIG. 1A to FIG. 1C, the LCD panel 20 is constructed with, mainly, a TFT substrate 1, a CF (Color Filter) substrate 2 opposing to the TFT substrate 1, liquid crystal 3 provided between the TFT substrate 1 and the CF substrate 2, a seal 4 for mutually adhering the TFT substrate 1 and the CF substrate 2 and sealing the liquid crystal 3, seal spacers [mixed] incorporated in the seal 4 and display area spacers 16 arranged on a display area surrounded by the seal on the TFT substrate 1. The CF substrate 2 is provided with red, green and blue filter layers 22. An initial average size of the

display area spacers 16 in a cell gap direction is set to a value equal to an appropriate cell gap value d0, which is necessary to perform a liquid crystal display appropriately. When the display area spacer is spherical or circular pillar shaped, the size thereof in the cell gap direction corresponds to a diameter thereof or, when it is a square pillar shaped spacer, the size corresponds to a side length of a square cross section thereof.

Paragraph bridging pages 9 and 10, beginning at page 9, line 9:

The state shown in FIG. 1C is a metastable state and sustained for some time period. If the hardening of the seal 4 were suspended for a considerably long time, the LCD panel 20 could be deformed in a manner that the cell gap becomes uniform throughout the LCD panel 20 due to the resistance of the display area spacers 16 in the center portion of the LCD panel 20. However, when the seal 4 is left in unhardened state for a too long time period under atmospheric pressure, there may be a case where the seal 4 is broken because pressure is directly applied to the seal 4 from the time when the LCD panel 20 is put under atmospheric pressure. Therefore, a time period from the time when the LCD panel is put in atmospheric pressure to the hardening time of the seal 4 is preferably from several minutes to several tens <u>of</u> minutes. For this reason, the seal 4 has to be hardened under the condition in which the cell gap in the center portion of the LCD panel is smaller than the appropriate cell gap and that in the peripheral portion is larger than the appropriate cell gap, as shown in FIG. 1C

Paragraph beginning at page 10, line 2:

The pressure acting on the seal 4 will be described with FIG. 2 which is a plan view of the TFT substrate including a pair of areas, which finally become two LCD panels, after the printing of the seals 4 and the dropping of liquid crystal 3 are performed therefor. In order to enhance the pressing force of atmospheric pressure to the transparent substrates after the latters

are adhered to each other, there is a case where an [arbitrary] auxiliary seal 8 surrounding the seals 4 is formed as shown in FIG. 2. The [arbitrary] auxiliary seal 8 is used to form a vacuum space surrounding the seals 4 and maintaining the enhanced pressing force.

Paragraph beginning at page 10, line 17:

When the [arbitrary] auxiliary seal 8 is broken by atmospheric pressure, the latter pressure is exerted on the outer peripheral faces of the seals 4. According to the fabrication method without using the [arbitrary] auxiliary seal 8, atmospheric pressure is, of course, exerted on the outer peripheral faces of the seals 4 from a time at which the panel is put under atmospheric pressure.

Paragraph bridging pages 14 and 15, beginning at page 14, line 24:

As will be clear from the foregoing description, spacers, which are not compressed to the appropriate cell gap by atmospheric pressure exerted on the LCD panel, for example, spacers having initial size, which is too large compared with the appropriate cell gap or spacers, which are of a hard material and are substantially not deformed although the size is a little larger than the appropriate cell gap, are not used in the present invention as the display area spacers, since the seal is hardened after the inner volume of the LCD panel becomes equal to the volume of liquid crystal. If such too large spacers or too hard spacers were used as the display area spacers, there [should] could be voids left in the panel and the inner volume of the panel does not become equal to the volume of liquid crystal in the LCD panel. That is, in the present invention, the conditions of the display area spacer are set such that it can be compressed up to the appropriate cell gap by deformation under atmospheric pressure exerted on the panel.

Paragraph beginning at page 18, line 10:

FIG. 3A to FIG. 3C are cross sections of an LCD panel 10 illustrating the fabrication steps of the present fabrication method. The LCD panel 10 is a TFT driven, color LCD panel. As shown in FIG. 3A to FIG. 3C, the LCD panel 10 is constructed with, mainly, a TFT substrate 1, a CF substrate 2 opposing to the TFT substrate 1, liquid crystal 3 filling a gap between the TFT substrate 1 and the CF substrate 2, a seal 4 for adhering the TFT substrate 1 to the CF substrate 2 and sealing liquid crystal 3 between, the TFT and CF substrates, seal spacers [mixed] <u>incorporated</u> in the seal 4 and display area spacers 6 arranged on a display area of the LCD panel.

Paragraph beginning at page 28, line 10:

Since the display area spacers of the LCD panel fabricated according to the present method are pinched between the TFT substrate and the CF substrate in a state in which the display area spacers are compressed at room temperature, deformation of the whole panel hardly [occur] <u>occurs</u> due to the presence of the compressive stress (resistance force) of the display area spacers. Therefore, the appropriate cell gap can be maintained throughout the display area of the LCD panel for a long period of time.

MARKED CLAIMS

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MARKED CLAIMS SHOWING CHANGES MADE

2. (Amended) A fabrication method of a liquid crystal display panel [as claimed in claim 1], comprising the steps of:

forming a seal member on at least one of a pair of opposing transparent substrates such that said seal member surrounds a display area of said liquid crystal display panel;

arranging first spacers on said display area on said substrate, said first spacer having an initial size in a cell gap direction larger than an appropriate cell gap necessary to perform an appropriate liquid crystal display;

dropping liquid crystal onto an area surrounded by said seal member on one of said transparent substrates;

forming a panel by sticking one of said transparent substrates on the other with said seal member in a vacuum chamber;

putting said panel under atmospheric pressure to deform said first spacers through a deformation of said panel; and

hardening said seal member after an inner volume of said panel becomes equal to a volume of said liquid crystal, wherein said first spacer is elastically deformable from an initial size thereof to a size corresponding to said appropriate cell gap.

3. (Amended) A fabrication method of a liquid crystal display panel, as claimed in claim [1] 2, wherein said seal member contains second spacers mixed therein, said second spacer being formed of a material, which is hardly deformed when it is pinched between said transparent substrates under atmospheric pressure.

4. (Amended) A fabrication method of a liquid crystal display panel, as claimed in claim [1] 2, wherein said first spacer is deformed to the size corresponding to said appropriate cell gap.

5. (Amended) A fabrication method of a liquid crystal display panel, as claimed in claim [1] 2, wherein a relative value of an initial average size of said first spacers to said appropriate cell gap is within a range from a value larger than 102.9% to a value smaller than 107.0%.

MARKED DRAWINGS

SERIAL NO. 09/855,148

DOCKET: NEC 142491

Approved 03/01/.03

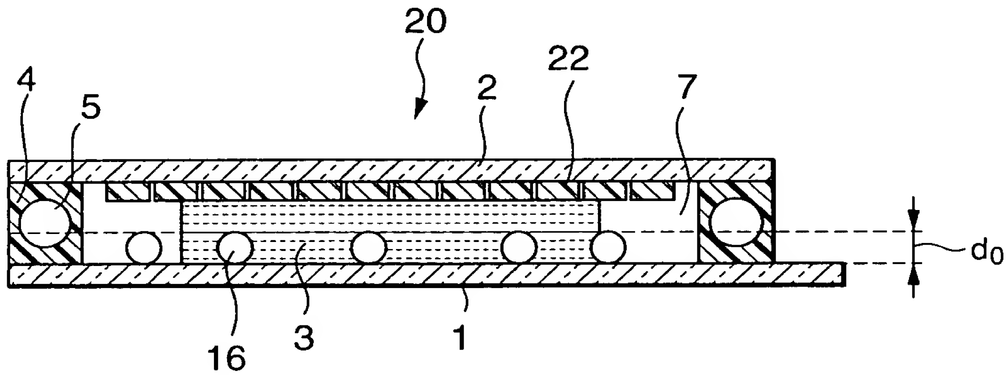


FIG.1A
PRIOR ART

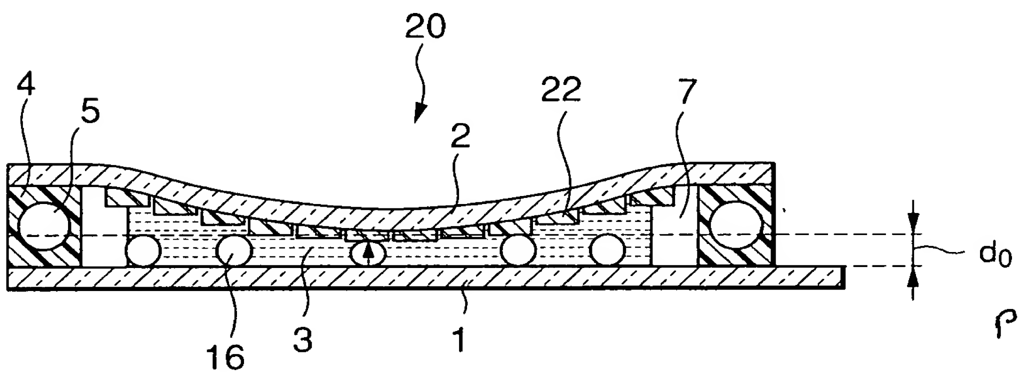


FIG.1B
PRIOR ART

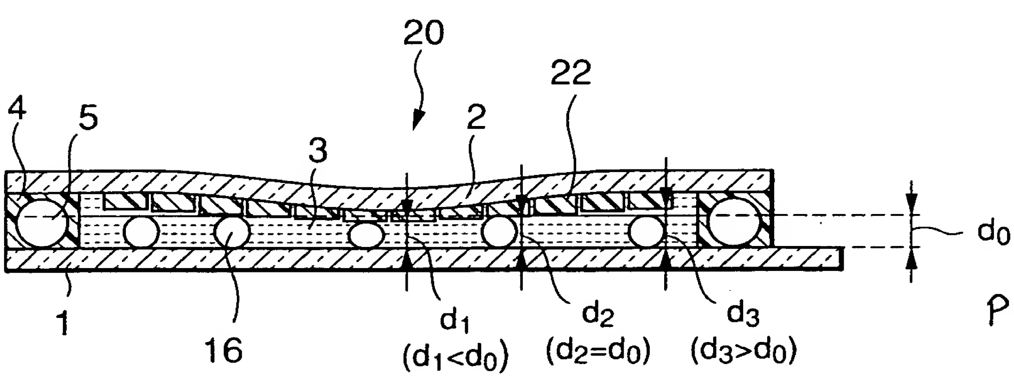
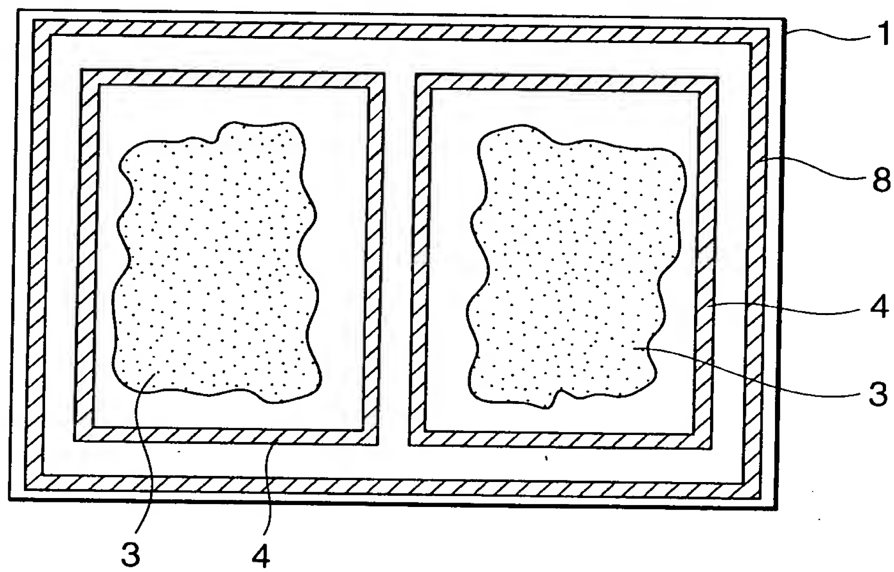


FIG.1C
PRIOR ART

Approved 03/01/03

FIG.2

PRIOR ART



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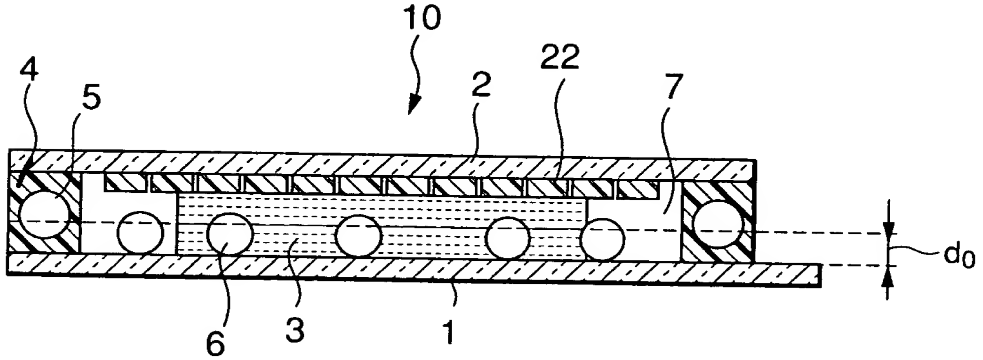

FIG.3A

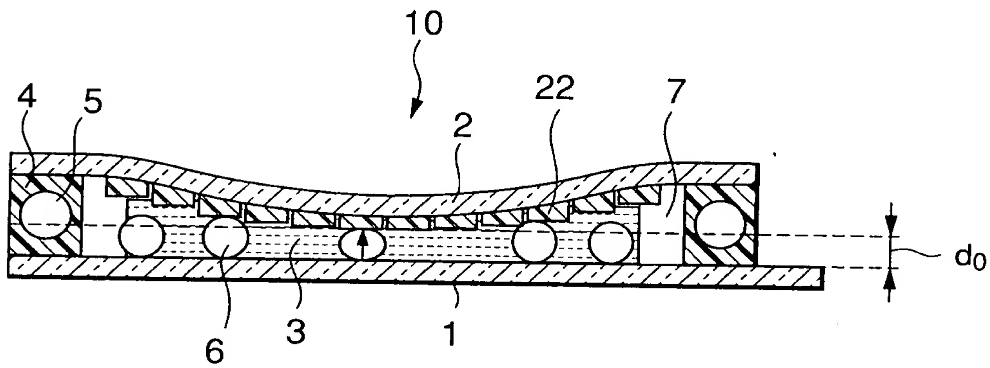

FIG.3B

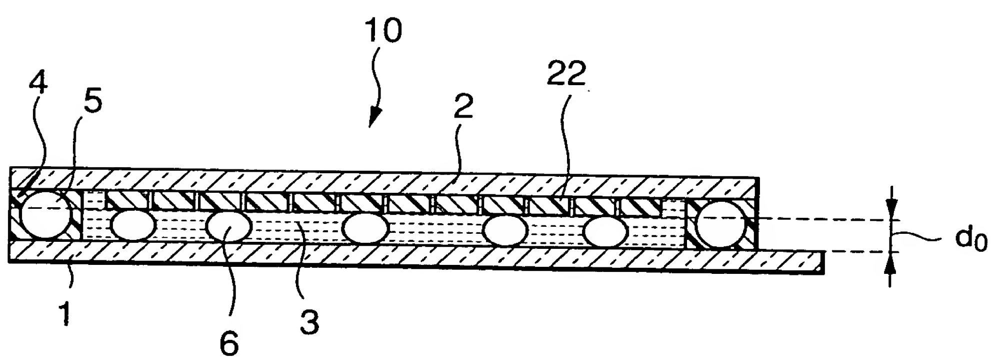

FIG.3C